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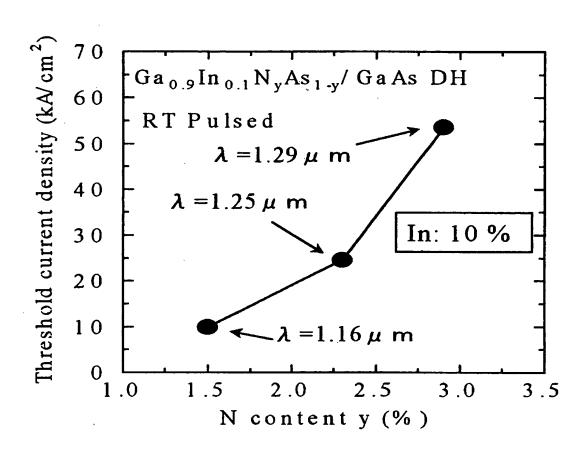
Inventor: Takashi Takahashi, et al.

 $\mathcal{H}_{\mathcal{F}}$

Title: SEMICONDUCTOR LIGHT EMITTER

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FIG.1



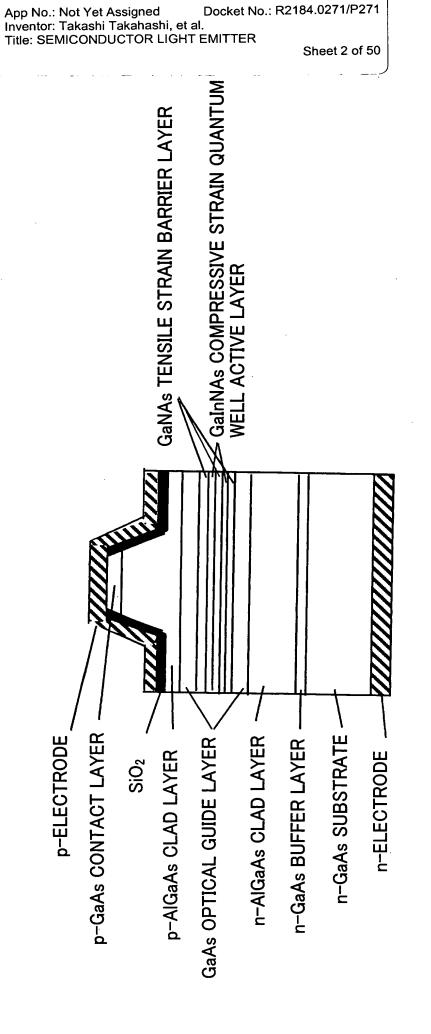
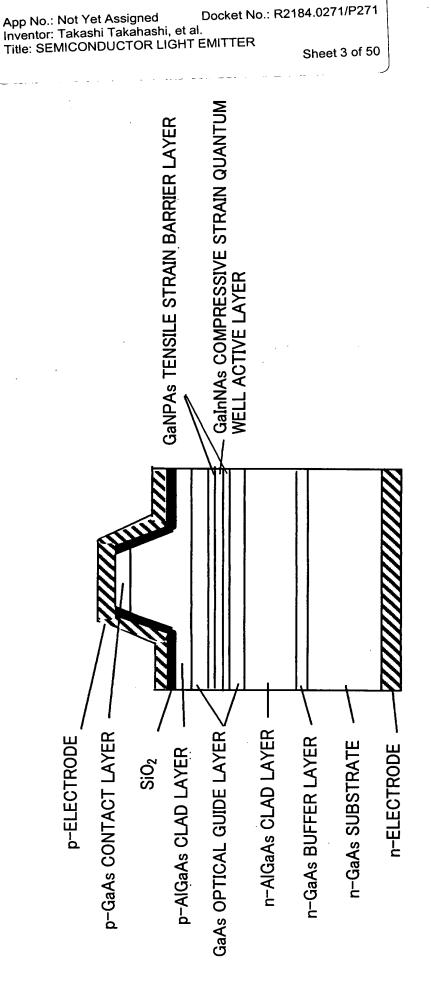


FIG.2



App No.: Not Yet Assigned Docket N Inventor: Takashi Takahashi, et al. Title: SEMICONDUCTOR LIGHT EMITTER Sheet 4 of 50 UPPER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR AIXOY CURRENT CONSTRICTIVE PORTION AIAS UNSELECTED OXIDE LAYER (CURRENT INJECTION PORTION) n-SIDE ELECTRODE GaAs SPACER LAYER GaAs CONTACT LAYER Al0.9Ga0.1As/ GaAs Ganpas Tensile Strain Barrier Layer LIGHT OUTPUT LOWER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR n-GaAs SUBSTRATE Alo.9Ga0.1As/GaAs p-SIDE ELECTRODE **QUANTUM WELL ACTIVE LAYER** GaInNAs COMPRESSIVE STRAIN INSULATING FILM (POLYIMIDE) INSULATING FILM (SiO₂) RESONATOR PORTION-

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FIG.5

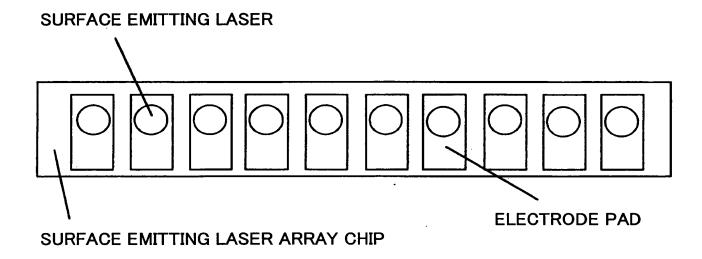
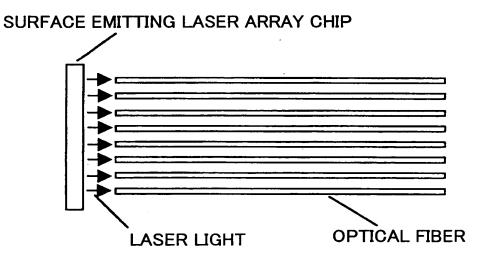


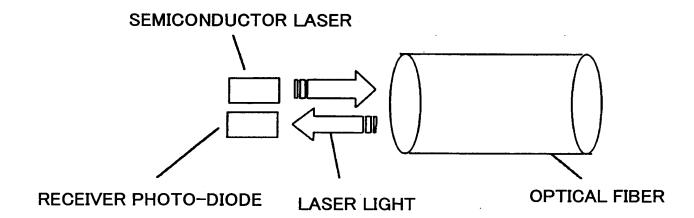
FIG.6



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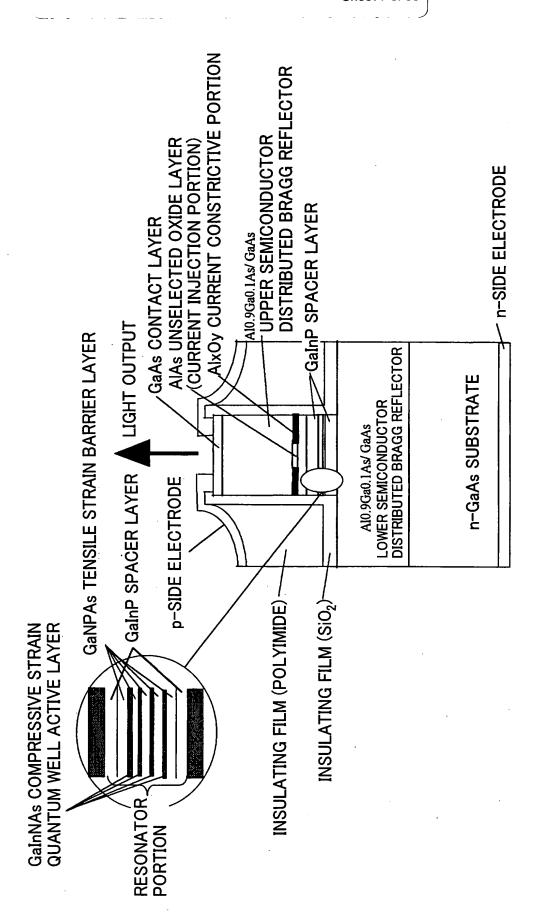
FIG.7



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FIG.9

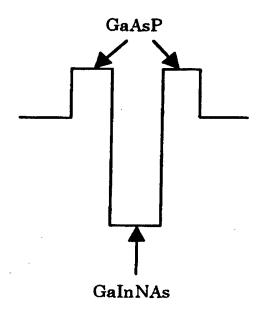
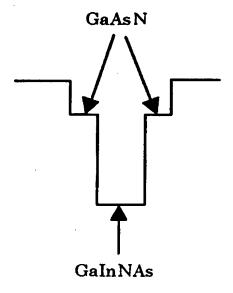
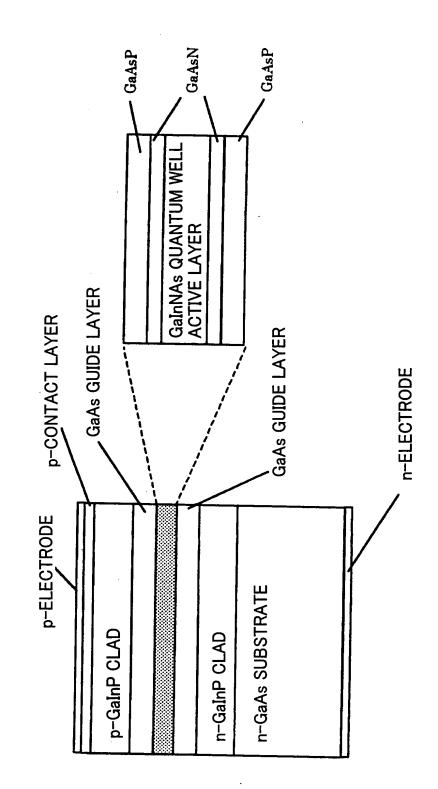


FIG.10



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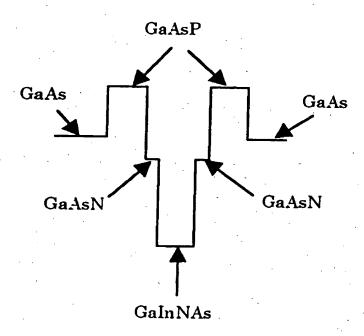
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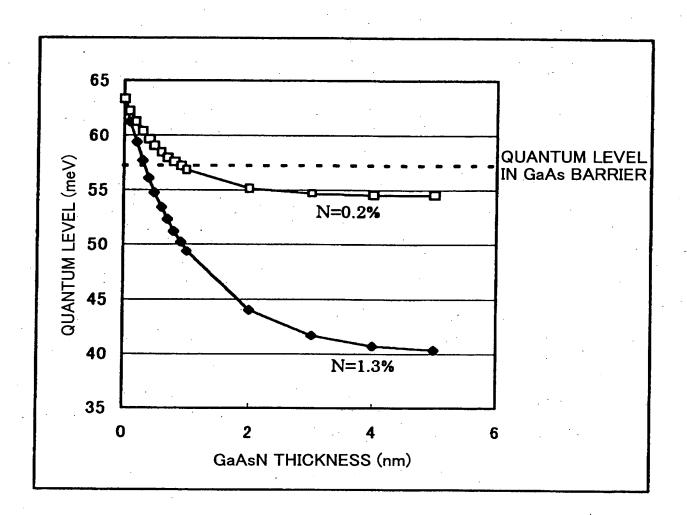
FIG.12



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FIG.13



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FIG.14

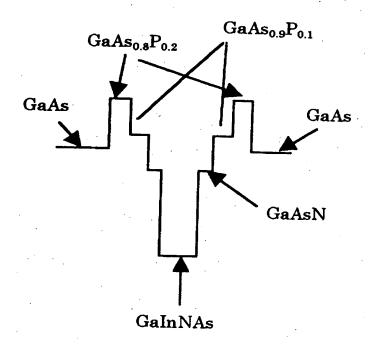
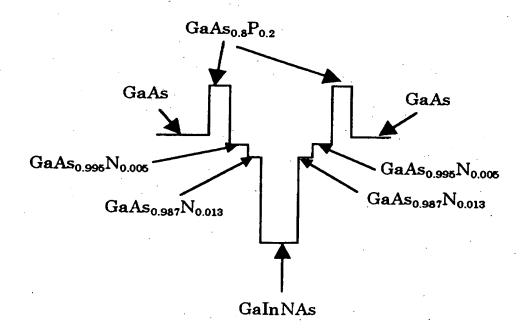


FIG.15



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Title: SEMICONDUCTOR LIGHT EMITTER Sheet 13 of 50 GaAsN GaAsP GaAsN GaAsP GaInNAs QUANTUM WELL ACTIVE LAYER GaInNAs QUANTUM WELL ACTIVE p-CONTACT LAYER GaAs BARRIER n-ELECTRODE p-ELECTRODE n-GaAs SUBSTRATE p-GaInP CLAD n-GaInP CLAD GaAs GUIDE LAYER GaAs GUIDE LAYER'

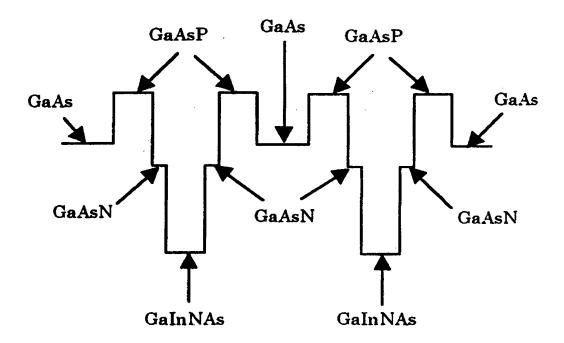
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FIG.17



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Title: SEMICONDUCTOR LIGHT EMITTER Sheet 15 of 50 GaAsN GaAsP GaAsN - GaAsP GaInNAs QUANTUM WELL ACTIVE LAYER GaInNAs QUANTUM WELL ACTIVE LAYER GaAsP BARRIER p-CONTACT LAYER n-ELECTRODE p-ELECTRODE n-GaAs SUBSTRATE n-GaInP CLAD p-GaInP CLAD GaAs GUIDE LAYER' GaAs GUIDE LAYER

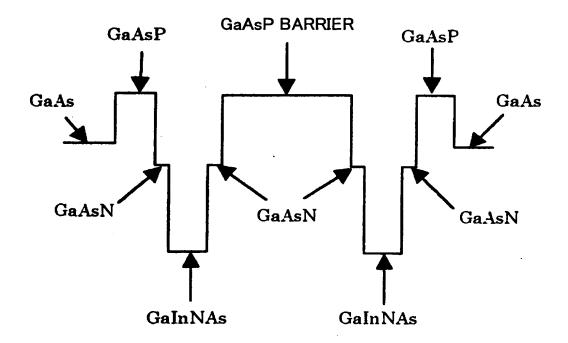
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FIG.19



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Title: SEMICONDUCTOR LIGHT EMITTER Sheet 17 of 50 GaAsN GaAsN GaAsP GaAsP GaAsP GaInNAs QUANTUM WELL ACTIVE LAYER GaInNAs QUANTUM WELL ACTIVE LAYER p-CONTACT LAYER GaAsN BARRIER n-ELECTRODE p-ELECTRODE n-GaAs SUBSTRATE p-GaInP CLAD n-GaInP CLAD GaAs GUIDE LAYER GaAs GUIDE LAYER

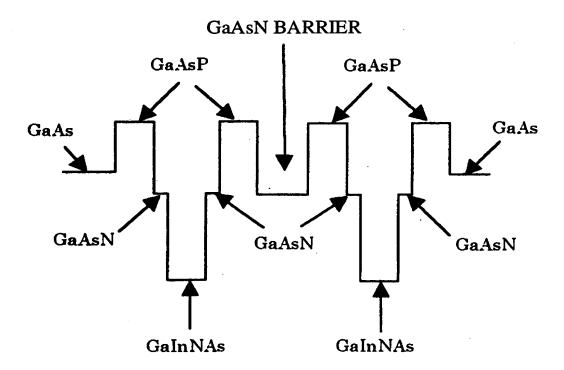
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FIG.20

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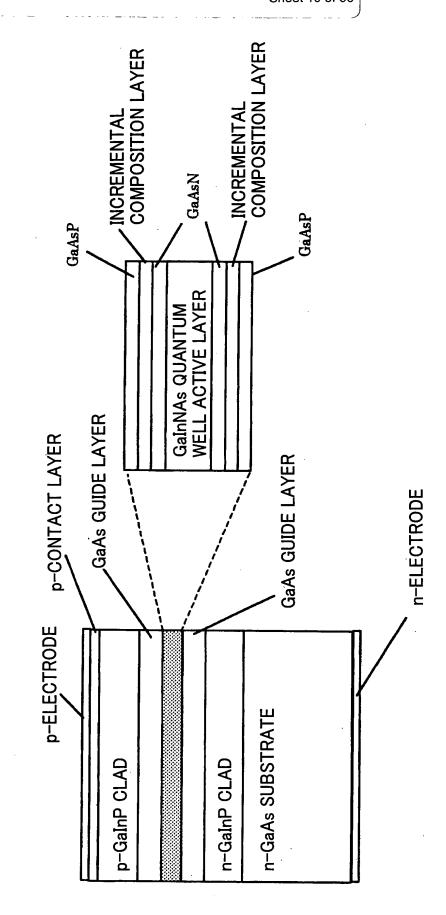
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FIG.21



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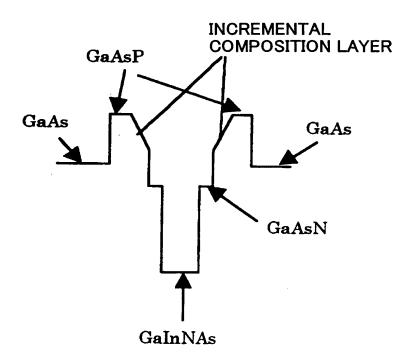
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FIG.23



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FIG.24

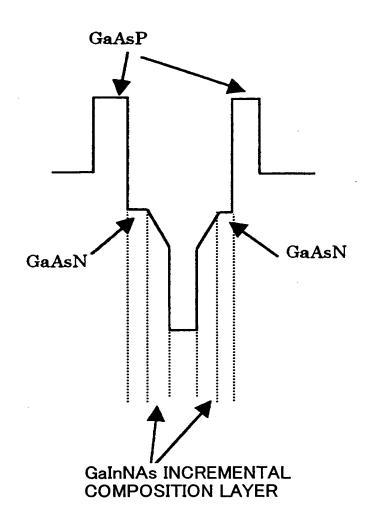
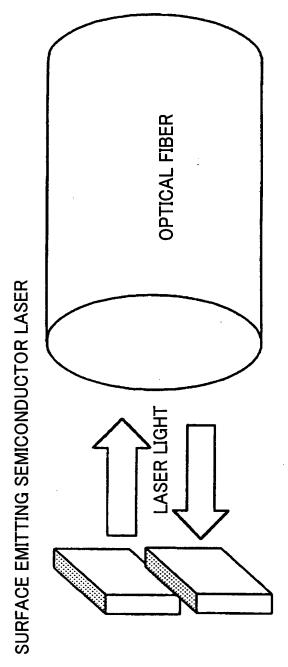


FIG.25

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FIG.26



RECEIVER PHOTO-DIODE

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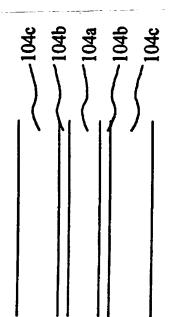


FIG.27B

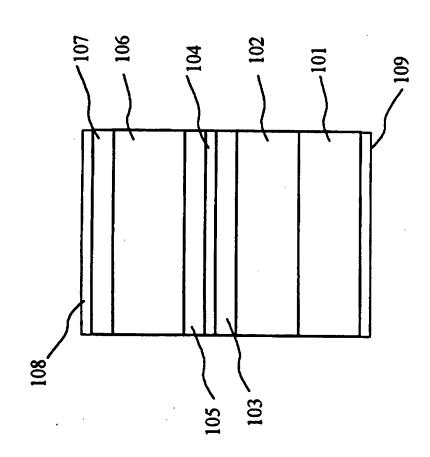
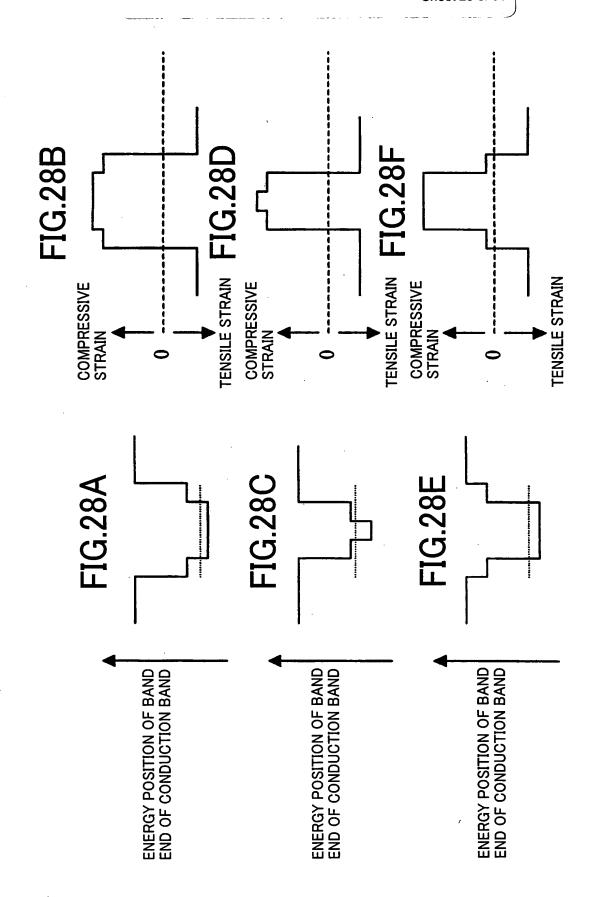


FIG.27A

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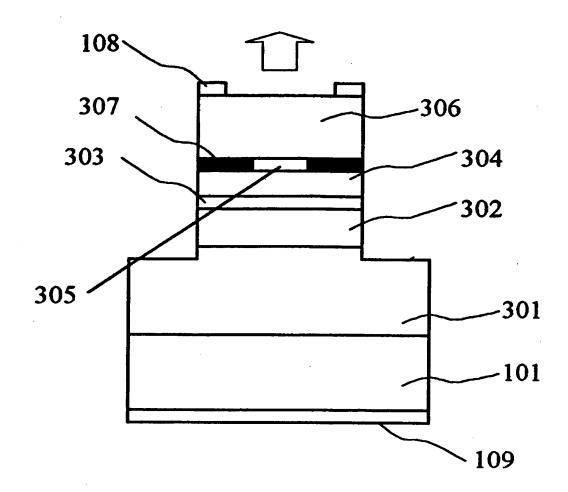
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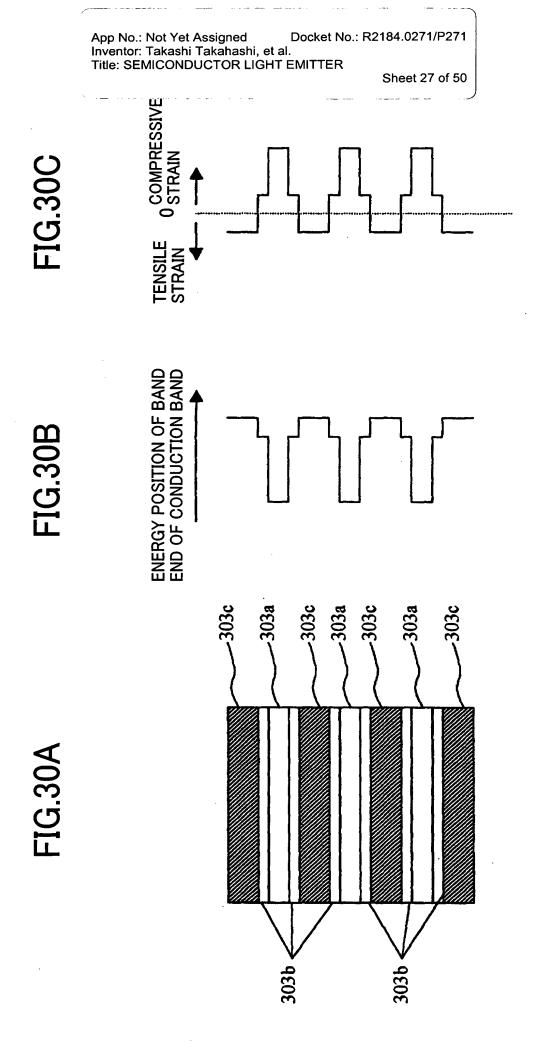


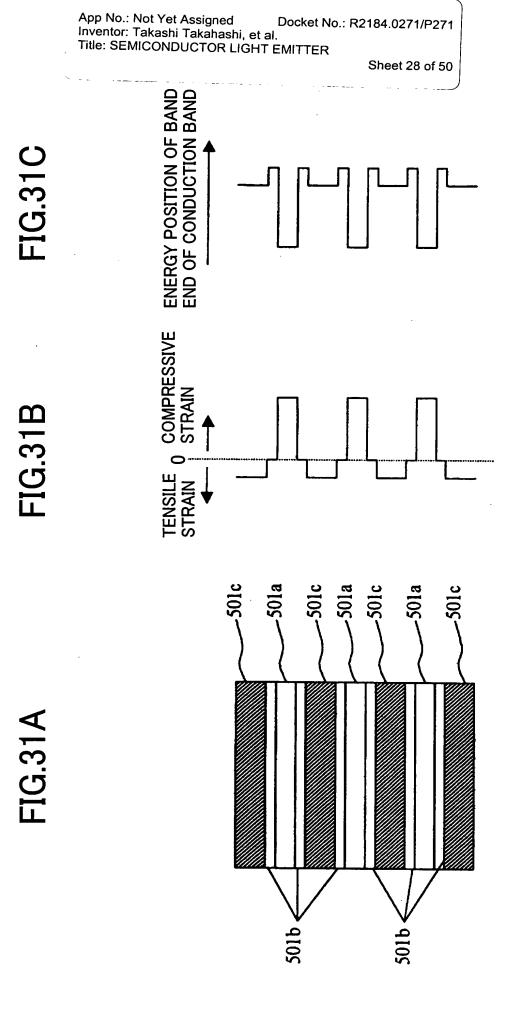
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FIG.29







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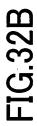
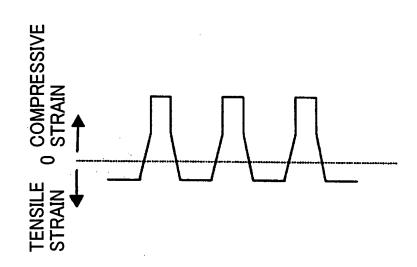
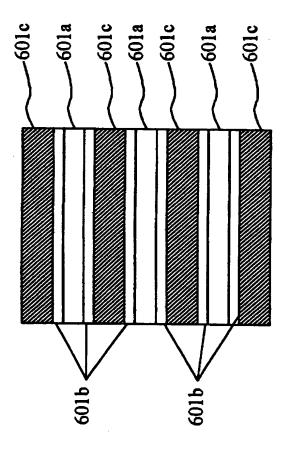


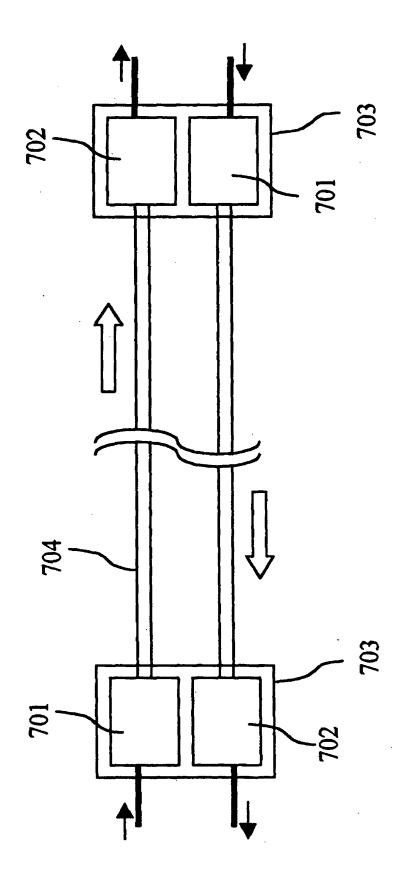
FIG.32A





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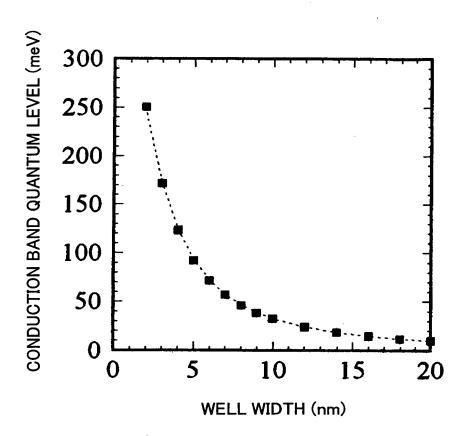


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FIG.34



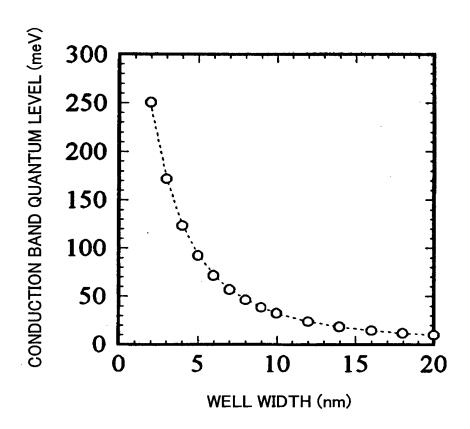
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FIG.35



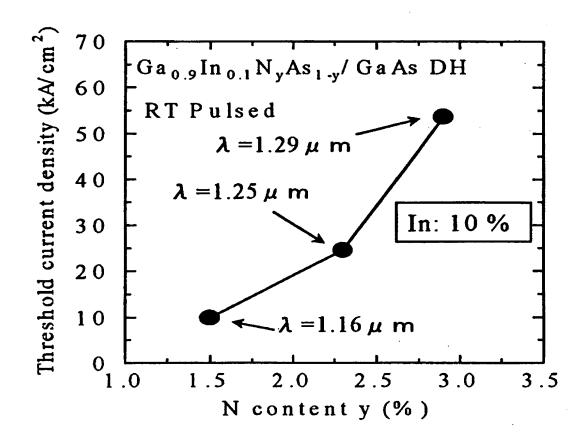
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FIG.36



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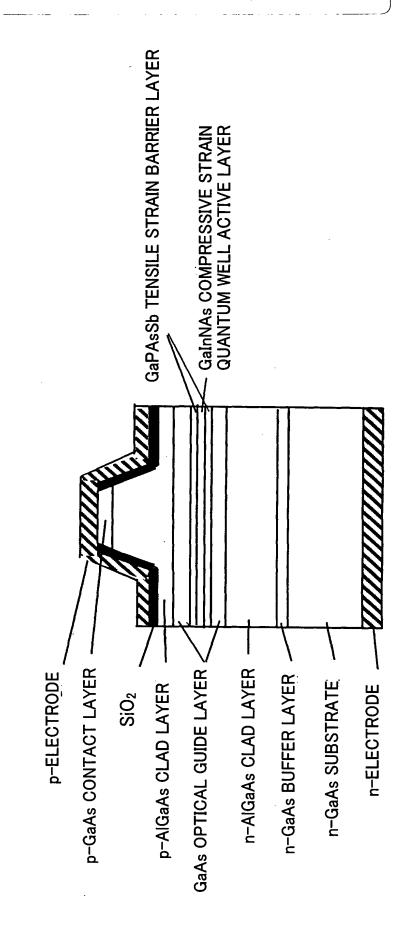


FIG.37

Inventor: Takashi Takahashi, et al. Title: SEMICONDUCTOR LIGHT EMITTER Sheet 35 of 50 GaNAsSb TENSILE STRAIN BARRIER LAYER GaInNAs COMPRESSIVE STRAIN QUANTUM WELL ACTIVE LAYER n-AlGaAs CLAD LAYER p-GaAs CONTACT LAYER n-GaAs SUBSTRATE ~ n-GaAs BUFFER LAYER – p-AlGaAs CLAD LAYER -GaAs OPTICAL GUIDE LAYER < n-ELECTRODEp-ELECTRODE SiO_2

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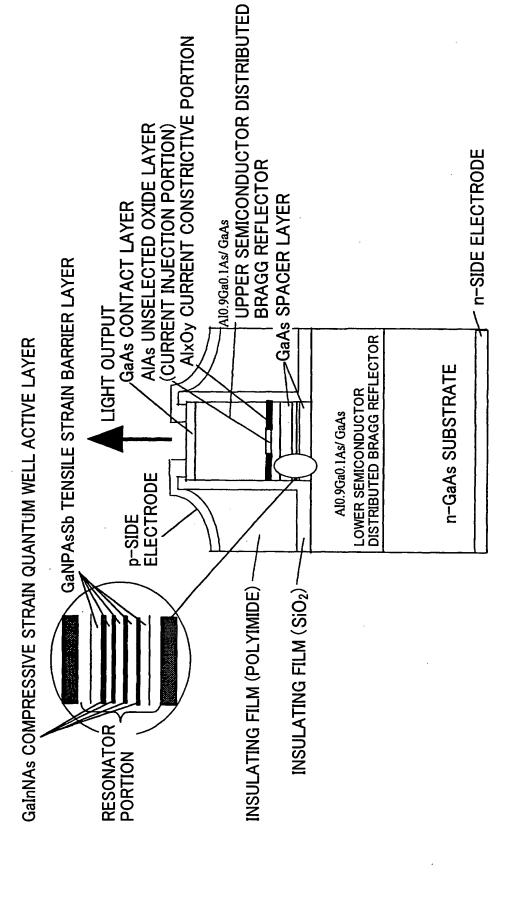


FIG.39

App No.: Not Yet Assigned Docket N Inventor: Takashi Takahashi, et al. Title: SEMICONDUCTOR LIGHT EMITTER Sheet 37 of 50 AIxOy CURRENT CONSTRICTIVE PORTION A10.9Ga0.1As/ GaAs -UPPER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR AIAs UNSELECTED OXIDE LAYER (CURRENT INJECTION PORTION) n-SIDE ELECTRODE GaAs CONTACT LAYER GaAs SPACER LAYER GaNPAs TENSILE STRAIN BARRIER LAYER IGHT OUTPUT GaInNAs COMPRESSIVE STRAIN QUANTUM WELL ACTIVE LAYER AI0.9Ga0.1As/ GaAs LOWER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR n-GaAs SUBSTRATE ELECTRODE p-SIDE INSULATING FILM (SiO $_2$) $^-$ INSULATING FILM (POLYIMIDE) INTERMEDIATE LAYER RESONATOR **PORTION**

GaAsSb

FIG.40

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FIG.41

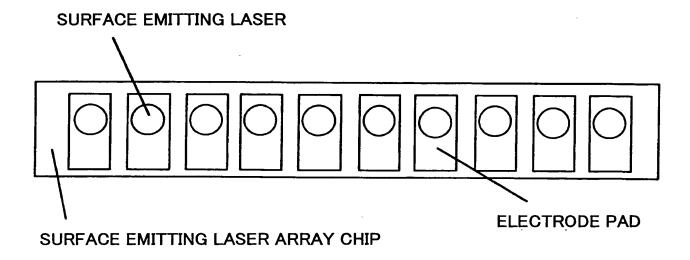
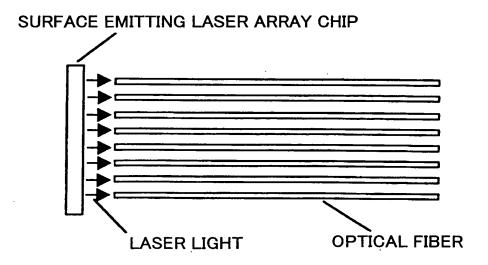


FIG.42



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FIG.43

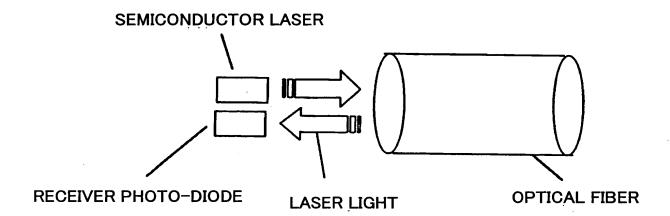


FIG.44

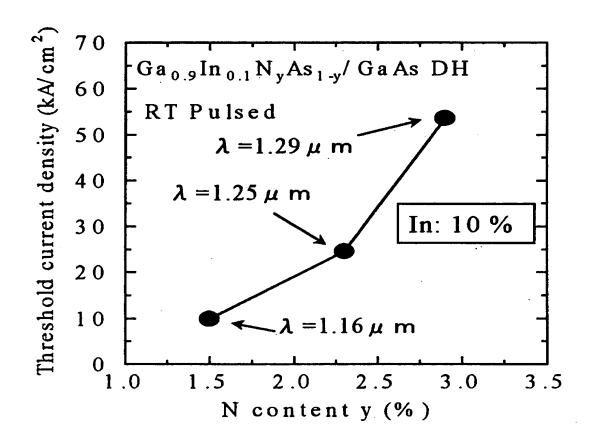
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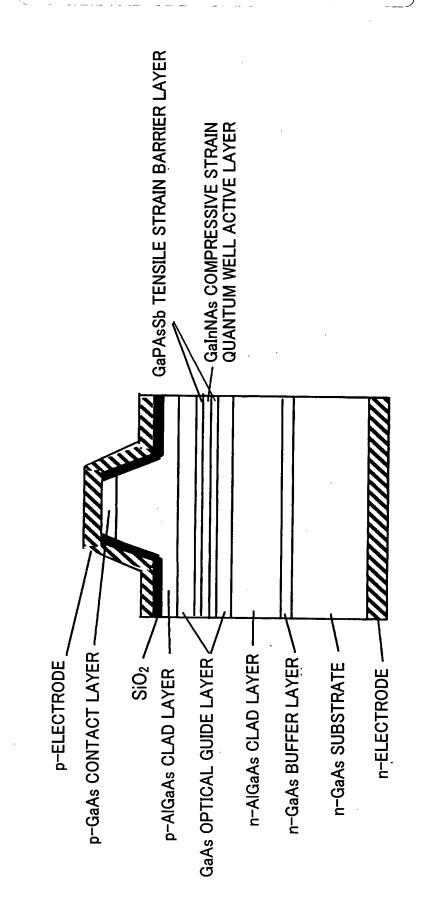
FIG.45



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App No.: Not Yet Assigned Inventor: Takashi Takahashi, et al. Docket No.: R2184.0271/P271 Title: SEMICONDUCTOR LIGHT EMITTER Sheet 43 of 50 UPPER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR AIXOY CURRENT CONSTRICTIVE PORTION AIAs UNSELECTED OXIDE LAYER (CURRENT INJECTION PORTION) n-SIDE ELECTRODE GaAs SPACER LAYER GaAs CONTACT LAYER Al0.9Ga0.1As/ GaAs GaNPAsSb TENSILE STRAIN BARRIER LAYER LIGHT OUTPUT LOWER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR n-GaAs SUBSTRATE GaInNAs COMPRESSIVE STRAIN QUANTUM WELL ACTIVE LAYER Al0.9Ga0.1As/GaAs p-SIDE ELECTRODE INSULATING FILM (POLYIMIDE) INSULATING FILM (SiO₂) RESONATOR~

PORTION

FIG.47

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(CURRENT INJECTION PORTION)
AIxOy CURRENT CONSTRICTIVE PORTION n-SIDE ELECTRODE GaAs SPACER LAYER GaAs CONTACT LAYER A10.9Ga0.1As/ GaAs GaPAsSb LATTICE MATCHING BARRIER LAYER LIGHT OUTPUT LOWER SEMICONDUCTOR DISTRIBUTED BRAGG REFLECTOR n-GaAs SUBSTRATE GaAsSb COMPRESSIVE STRAIN QUANTUM WELL ACTIVE LAYER Al0.9Ga0.1As/GaAs p-SIDE ELECTRODE INSULATING FILM (POLYIMIDE)-INSULATING FILM (SiO₂) RESONATOR PORTION

FIG. 48

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FIG.49

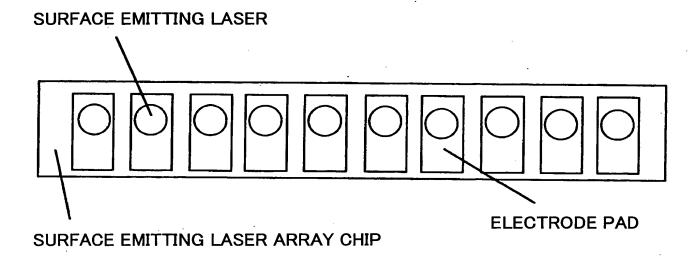
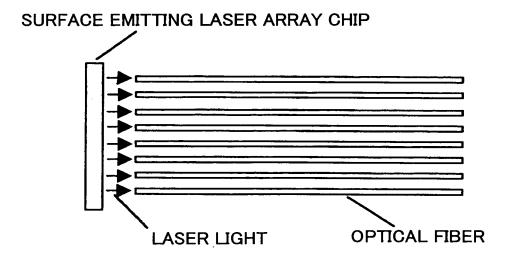


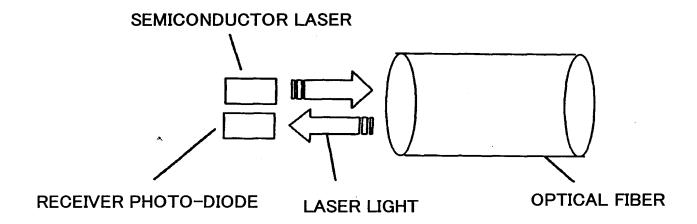
FIG.50



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FIG.51



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FIG.52

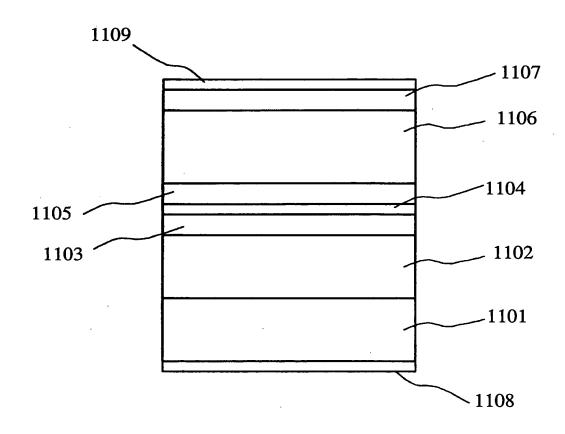
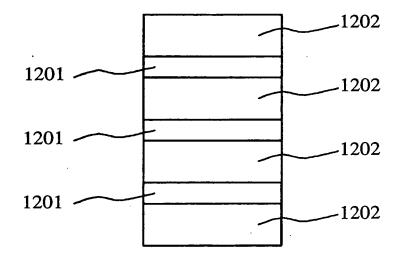


FIG.53



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FIG.54

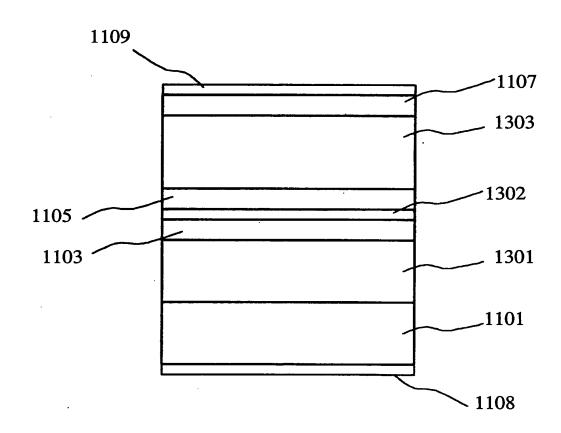
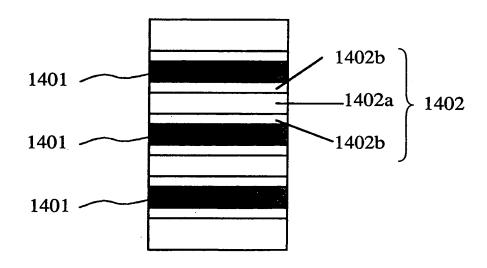


FIG.55



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FIG.56

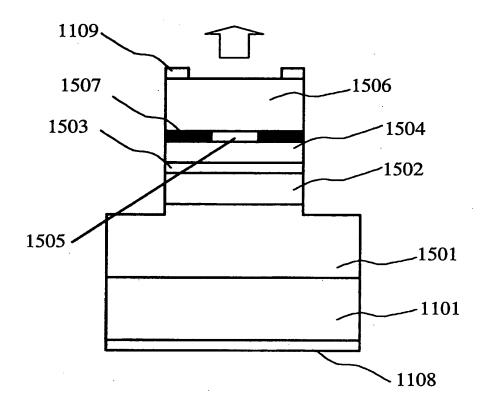
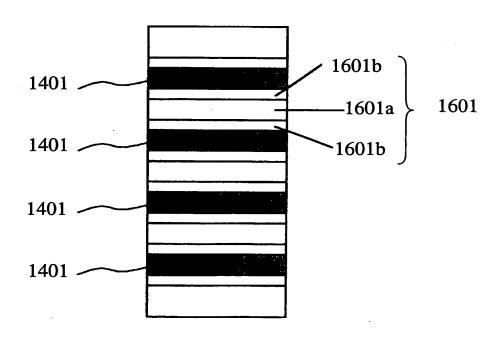


FIG.57



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